Introduction to Cognitive Psychology

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Lecture – 09
Automization and Attention

Hello. So, we are back again today with a section on attention. A brief review of what we have done up till now in attention. So, in the previous classes we looked at what is attention and the various factors which go ahead and define how attentional really works out to. So, specifically we looked at this brain process or this mental process called attention, how it goes ahead and distributes the cognitive the terms which is available and how attention is equivalent to mental concentration.

We also looked at a method of going ahead and performing attentional studies, and in that we saw a brilliant experiment by cherry, which is called the dichotic listening task. The reason why this experiment was designed was because attentional studies are difficult to carry out. And so, after defining what cherry looked into, or what cherry is experiment brought out it the common result from the study was that those stimuli which we focused our attention to mental concentration to those what processed, but those stabilized to which we were not putting any mint metal concentration from the unattended year they were not processed.

But amazingly the study did bring out this fact that some physical features of messages from the unintended year was also processed. Now moray came up and gave counterexample or basically problem with the cherry study which was the cocktail party effect. And through his cocktail party effect phenomena he showed that attention even if we are not paying attention to some stimuli they passed the threshold. So, they are registered on to our attentional system.

So, working on this assumption that the even if we are not paying attention to some stimuli they are processed, several theories were developed. And so, the first theory was the filter theory which I explained attention as filter, and the filter works on physical properties of the incoming stimuli from perception. And so, they find that only those events to which we perceive our attention, gets passed out and all other stimuli to which we would focus our attention gets excluded at the attentional filter.

And at Richmond added a new theory into this whole idea of attention she defined or showed that those stimuli which were not processed or which were at the unattended year were actually it is it is not that they were not processed the volume were do not down they were attenuated. And through a clever experiment she showed that people's attention actually worked as all or none kind of a phenomena. And her task was the year switching tasks.

So, basically on a tradesman showed that it is not that the unattended here the information from the unattended here does not get processed they are toned down. And so, if need be or if the threshold of the incoming message is such that it is it is low they to get processed. And so, an additional theory a new theory was also proposed which is called a late selection theory, which argued against the filter theory saying that the bottleneck or the filter that we talked about in terms of processing of incoming messages does not exist at the very beginning of a message.

But at the late part of a message which basically means that most messages are processed till the meaning level till a basic meaning level. In addition to this we had the multimodal theory and another theory which talks about the stages of processing of any stimuli through the attentional filter. And so, the model theory defines that there are 3 stage of processing or there are 3 attentional filters which exist and depending on at which stage 2 messages appear different to the cognitive system that is the point at which the filter is applied.

So, at the first level what happens is 2 messages are differentiated on in terms of the phonology in I am sorry not the phonology, but in terms of the basic physical properties like what is the tone of it how intense it is and so on and so forth. And the second level it is the semantics or the phonology and semantics of the message which basically goes ahead and designs the filter or is responsible for filtration, and then there is a third stage if the messages are same in terms of basic meaning and the basic physical properties a third level or higher dimensional level is chosen for distinguishing 2 messages.

And this dimension uses both the physical properties phonological properties and the semantic properties of the message. So, all 3 are considered and differentiations of messages are done. So, this is about the attentional theory. Now in addition to this we also looked at something called automation. The question was whether if we do enough

of practice, can we go ahead and make a task automatic which basically means that it requires lesser and lesser attention.

And so, more attention is available or more resources are available for putting ourselves to or doing some other work. And we define certain limits to it we define certain features of how preferences of attention really work, and what is the basic factors which govern this autumn a city that we are talking about. And in one of the interesting examples that we took in the last class, which explained in the last class was the stroop test. So, we saw that if enough practice is done if enough if enough practice is applied attention can be made automatic. And so, just the slides that you are seeing right it is the last sight from the last class which shows that with enough practice atomization happens.

So, in today's class what we are going to see is the atomization, how does this automation really work; this automation of attention really works, and how is it helpful. I will also look at what is the difference between an automatic system, and automatic processing of message and a control processing of message.

So, attentional systems how are attentional system 2 systems which use on automatic processing in a control processing how are they different and what are the factors governing them. In addition to it we will also look at some of the examples or some of the good outgrowths of this attentional study, one are growth that we look into is something called the psychological refractive period. So, let us continue with a discussion of automatic of attention.

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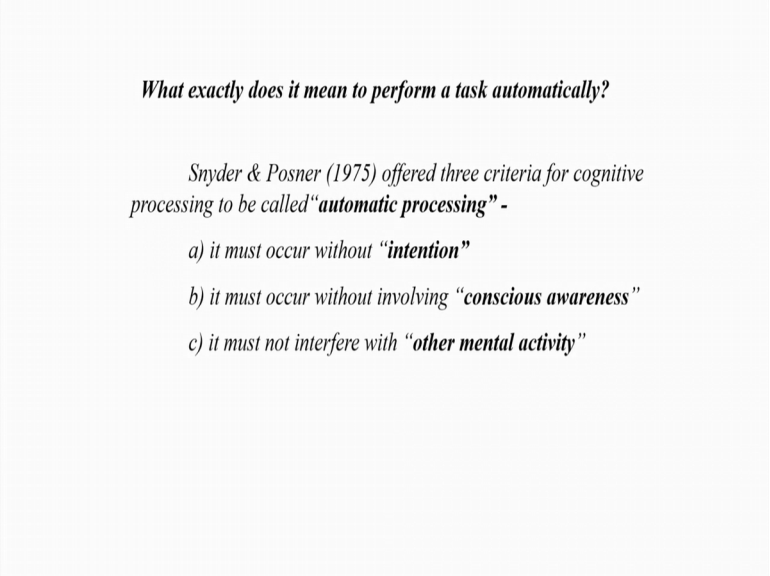

So, basic question which is in front of us right now is what does it mean to perform a task automatically. Authorization of task performance what is the meaning of that particular thing? And an answer was given by Snyder and posner in 1975, and what they said was attentional processing is automatic or there is an automation of attentional process only when it fulfils any process fulfills 3 different things or 3 different features.

The first is that the task that is at hand the task which is getting process must occur without an intention. Which means that an task is said to be getting processed automatically with automatic attentional systems with the help of automatic as natural systems it requires no intention at all.

So, as soon as we develop an intention as soon as we think of a task and we develop an intention to do that particular task, then this particular task does not become automatic. So, in automatic task processing requires no intention. And I will give an example to see how this optimization really works. So many a times in your everyday routine, you would have seen that the path from your university or the path from the place of your work to your home is somewhat automatically remembered to you.

And so, at time what happens is when some other job for some other task is getting into your head for example, some other work related or university related problem is bugging you in some way, if that that is what is happening, then what would happen is in those times you will automatically drive towards or automatically move towards your home,

and this movements instance you the path between your home and your work is so well learned that if another task is taking up your attention you do not even realize that you had to go to the market. But then what has happened is since the your attentional capacity of mental resources were exerted were engaged somewhere else you automatically turn towards your home.

So, which basically means that turning towards the act of turning towards your home is without intention. And that is why it is an automatic process, because you didn't decide to go towards your home you were deciding to go somewhere else, but since the mental effort the attentional processes were not available. And so, since this task is so, practiced this way from your home to the university or university to your home is so well practice so that that unintentionally there without an intention you move towards your path because this is what you every day.

Now, the second process or the second feature that should be involved in an automatic processing or automatic processing of task is something called conscious without the task should happen without conscious awareness. So, if you make in mind or if you keep in mind the fact that I have to do a particular task, and you do it with that formal intervention consciously which means that you remind yourself somehow, they will do this task.

Then doing that task they will require attention and will not be automatic. For example, in our like in the one plot that I just gave to you where you move from the since your attention is so occupied you have move from your university to the home and you in that path you automatically go towards your home. In that particular example the act of moving or taking the turn which separates the way to the market to the way from the way to the home, the act of turning towards your home is without conscious awareness.

So, you have not decided it you have not form an intention, and it is without conscious awareness you. Never planned it before and so it is automatic in nature and the third thing is that these tasks should not be, or should not have any kind of interference from other mental activity. The meaning of this is that if another mental activity which is similar to the automatic task, whether to the task which has requires automatic processing or which goes to automatic processing if they are same, what would happen is the task will no more be automatic.

So, in our example since our problem our university problem has engaged you in certain way, and it has nothing to do with motor movement it has nothing to do with thinking about going home, or anything related to you going to home this other task which you are thinking takes up a lot of your mental activity, a lot of your mental resources and this mental activity is very different from the walking task or writing the or whatever way you communicate from universe with the home.

And so, since the 2 task have very different in nature, the second task of in evidently of unintentionally moving towards your home or taking the turn towards your home becomes automatic in nature. So, basically summing it up any automatic tasks should have 3 features into it, should be done it shouldn't be done with an intention, it should not have a conscious awareness behind it. So, which basically means that you should not be consciously doing it, and the third is that this task should not be interfered with any mental activity. Should a mental activity interfere with it, the task will not be becoming automatic or the task would not become automatic.

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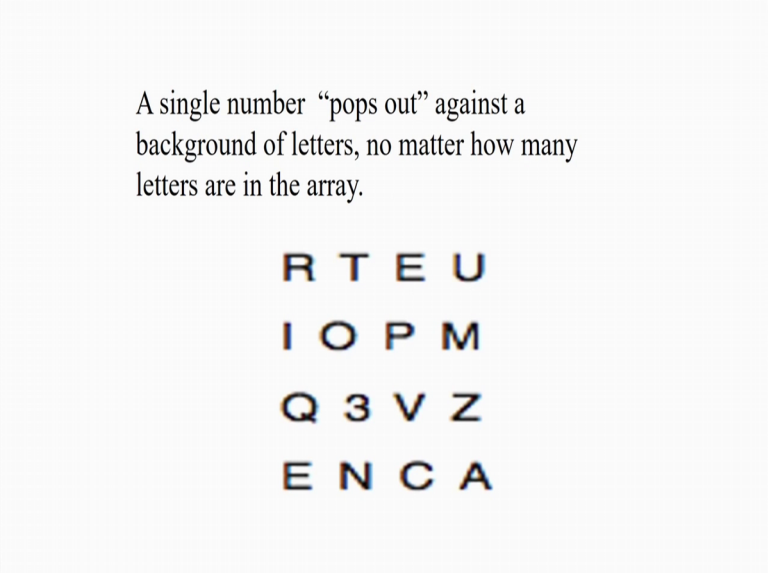

So, next let us take a look at what does it mean to have a controlled process tasks an automatic process task. What I mean by here is that those tasks which require at a control processing attentional processing, and those tasks which require unintentional processing or intentional processing which are automatic in nature, what is the difference between tasks like this?

Now so, one of the interesting things is before discussing this is something called attentional capture we will come to that in a moment. So, look at the display in front of you. Now in this display if I asked you to find out the one item which does not belong to the display your answer is very quick that, 3 is the word or 3 is the letter which pops out or which is not equivalent to what the display is. And so, this is called the pop-up phenomena and this becomes this is an automatic phenomena.

So, those but if I ask you to find out the specific letter for example, say the letter I or let us see it will take more time. So, 3 throws out itself to you. And so, it becomes automatic. And whereas, searching for I or c in this display is a more controlled task, because it will require you to go ahead and basically do control processing attentional processing of finding this letter. So, distinguishing this how this control and automatic processing works and what are the factors which controlled it Schneider and Shiffrin in 1977 designed a very ingenious experiment to test whether or what are the factors which control or which go ahead and define an attentional and a non-intentional processing.

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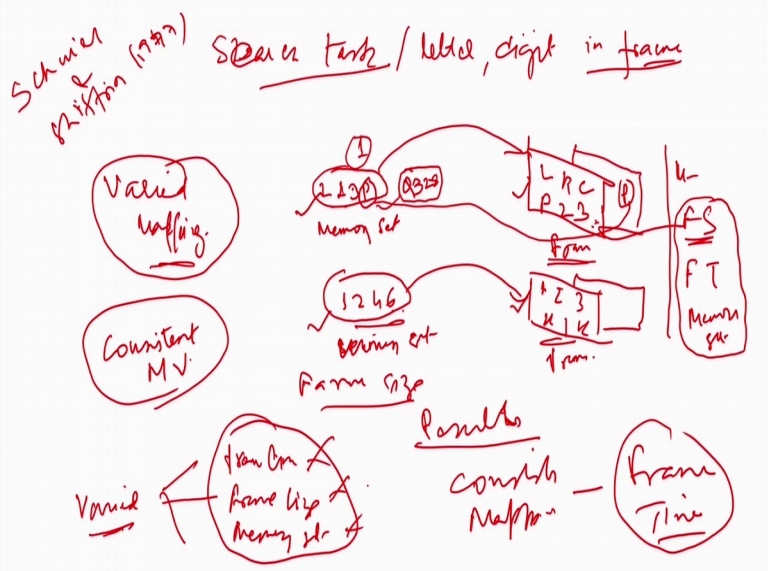

So, basically it is a search letter it is a search task and the search is either of a letter or of a digit in frame. So, it is a very simple task certain target is given, and you have to search this target in a particular frame. Now there are 2 different versions of this particular task. One is called one version is called the varied mapping version, and the other is called the consistent mapping version of this task.

So, what is the task like? The task has a certain target. So, these in the varied mapping version of it, you would have targets as both letters or a digit or a letter as a target. So, you can have L 1 3 P as a target. Whereas, in the consistent version of the task you either have letters or you have digits. So, you can either you have 1 2 4 6 as the target because this is what you need to search in the frame. So, this is called the memory set. This is what subjects have to commit to memory, and then there is a frame that you have to search these targets from.

So, one difference between varied, and consistent mapping is that in varied mapping we could have both numbers and letters as in the memory set the set for to which you need to compare. Whereas, in the consistent mapping either have numbers or you have letters. Then you have a display like this, which is call the frame. And what you need to do is you need to search this in the frame. So, in the varied condition you would have either letters or numbers on to the frame of such though. So, what you need to do is to find out whether this is present in this frame or not.

So, it could the memory set could be one letter it could be 2 letter could be 3 letter, depending on the different versions of the task it could be anything. And the task is to search whether this memory set is present in this frame or not.

The difference is I also go along telling you the differences between 2 versions of the task in the varied version you have either letters or digits that need to be searched where is in the consistent for a version you all only have either letters or digits. Similarly, in the frame set also there is a difference. The difference here is that in the case of varied mapping version the search in the frame set, what you are searching in the frame the frame could also have both letters and digits whereas, in the consistent version if I am searching for numbers or if I am searching for digits, you only have digits which are reported here.

Another interesting thing or another change or which distinguishes these 2 versions of the task is, that in this version in the varied version one of these letters, one of these item and the memory set could become distractor into the next frame. For example, I have P here in the memory set; this P can very well appear in our different memory set. And so, what would happen is since P is available here, now it is a target in this case these this P, because the next search item is Q 3 2 8. And so, in this case Q is the letter here and P

which has been used previously in this memory set which was an item of the memory, now is a present here with served as a distractor whereas, this is not true for the varied and the consistent mapping of it.

So, 3 differences first of all what happens is that memory set there is a difference in terms of memory set memory set in the varied version could be both letters and numbers whereas, in the consistent version it is either letters and numbers. Second the frame set could have both letters and numbers in the varied condition whereas, in the consistent condition it will either be letters or it will either be numbers both is not true and third that one item or any item from the memory set can become a distractor in the next frame in the next trial of the task whereas, each trial is new, or each new each new presentation of frame is actually new, it has nothing from the older memory set.

So, an experiment was done like this, and people were supposed to find out this or basically go ahead and tell whether this particular memory said is present in this frame or not. Varying these 3 other factors were varied in addition to whatever we have discussed here. So, one factor which were varied was called the frame size of the frame. So, basically how many letters do appear here? So, frame size is equivalent to how many letters or how many digits are appearing in the frame. The second thing that was there is for how long. So, frame size and then frame time? How long these frames were presented? So, you see a target and the frame is shown to you. And so, the length of time for which the frame was presented to you.

So, it was a first frame presentation or a slow frame presentation. And the third thing was the memory set itself. So, how many letters were present in the memory set that you need to search it could be one it could be 2 it could be 4? So, depending on and 4 was the highest number which was there. So, I have displayed the highest number it could also be just one letter one that you need to search.

So, these 3 factors were actually used, and this kind of a search task was design. The results were very interesting. So, there is a good amount of work, or there is a good amount of results which are came out of the study and it proposed some of the very good outputs in cognitive psychology, and I refer you I will I will basically suggest you to read this Schneider and Shiffrin experiments. So, Schneider and Shiffrin 1977 this experiment was done.

So, let us focus on to some of the most consistent resources the study in through this study we are trying to see how does consistent mapping, how does controlled sorry, how does controlled processing and at an automatic processing work. So, let us look at the results which are akin to these 2 problems. So, what are the results then? And so, the results that we got or the results that these psychologists got to us in the varied condition all 3 factors, right the frame time the frame size and the memory set had a role to play in to how fast you are actually passing.

Now if you look into it is it is actually the consistent mapping is representing something call automatic processing, and varied mapping requires something called controlled processing. Because what could happen is that the memory set could memory set could have numbers and letters growth, and similarly the frame put have an numbers and letters. So, you need more attentional system to process and so, the results suggested that the varied mapping condition, all 3 factors actually went ahead and showed their effects 1 2 results. Whereas, in the consistent mapping condition only you have guessed correct it is the frame time. How much time the frame was present.

Because one of the things is that is encoding. So, if a stimulus is not encoded at all controlled processing cannot take place. So, since it is letters verifying letters and numbers, verifying numbers, the only factor the only variable which went ahead and affected or this consistent mapping paradigm was the frame time. Whereas, inconsistent in the result for vary varied mapping condition, you have the frame size the frame time as well as the memory set of how many letters are being searched. All 3 of them made their marks into it or made their effects or showed their effects on to this search process.

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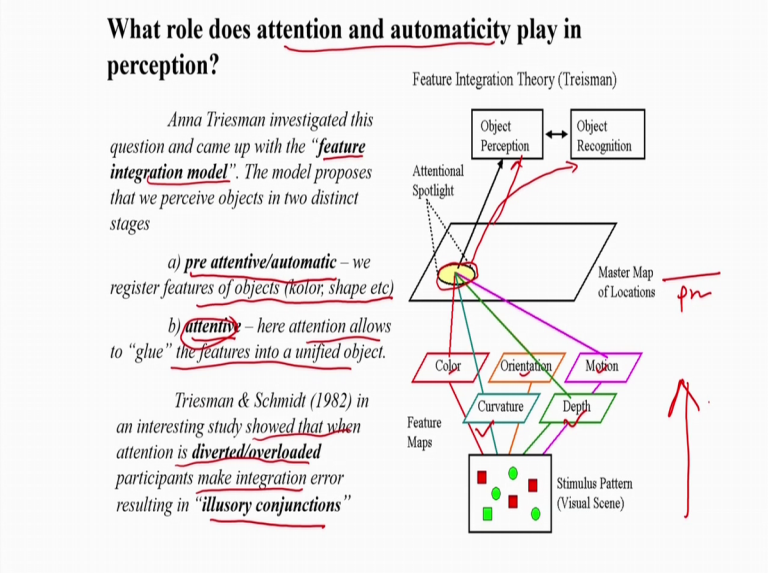

So, the thing is attentional is a cognitive capacity and just before attention to start or part of attention also works in terms of perception. So, we seen or a sectional perception, and it is a good time to ask the question what role does attention play in perception. And this is the exact question which was asked by Anna Triesman she asks the role of attention in automaticity of attention of control an automatic attention that plays in perception. And so, what very briefly what the theory says is that attention has a lot of role to play in perception, and what is it Anna Triesman investigated through the future integration model and what we find out is that any perception to take place has 2 stages.

So, perception is basically a 2-stage process. It starts so; this is a bottom up process it starts this way. In stage one what happens is it is called the pre-attentive stage and in stage one what really happens is that the physical features of a stimulus that is incoming in into perception into perceptual system into the perceptual module for processing those basic features are integrated together. And so, we register features of object color and shape into the creativity stage. So, perception is a 2-part process because attention plays a role into it.

In the first part of perception the basic features of any stimulus are recorded or map or integrated. And then there is a attentive stage or second stage. So, first stage basic features are integrated together or a whole is combined through various other features of the incoming stimuli, here attention allows to glue the features together. So, basically this

is as you can see there is a curvature depth motion orientation color these are the physical features. And so, these features this is the pre-attentive stage in which these features are actually integrated together under the attentional spotlight to discuss the attentional spot spotlight paradigm.

And only this attentional spotlight only after this is integrated together here does the attentive stage works through which a meaning is generated to object perception, and object recognition is takes place at the attentive stage. So, think of it in this way as you as we see something, as soon as we see something initially in the first stage things like color shape texture gradient this kind of things are available to us.

But if we if that particular image or if whatever we are seeing is available more time, they looped together to make a meaning. Which basically suggests that if something is presented to very fast, people will be able to tell the physical features, but may not be able to tell what does the thing mean, or what is the object in terms of our recognition and this particular feature where if a stimulus is presented very fast. So, that the attentional stage. So, that the attentive stage is somehow hindered people report something called illusory correlation.

So, if a stimulus if 2 features of a stimulus is present it very fast, what really happens is the at the pre-attentive stage automatic stage recognizes the features of the stimulus. And so, late, but the gluing is not correct you do not know what is what think of it in this way. If I quickly show you 4 different cars, in 4 different colors in 4 different model when I show you for one thousandth of a second kind of for 100 of a second kind of display and very quickly I. So, I show you this and very quickly, I take it away and then ask you what do you actually see in terms of the tell me the colors of the car tell me the models of the car and also tell me which car was rich model. Amazing you will find out that you could tell me the color of the car, you could also tell me how the model looked like because the model is basically the model of a car is displayed by the logo of the car.

So, you can perceive the features of the logo or the image of the logo. And so, you can tell me what car was present. So, you could go ahead and tell me that the blue car was present in a in a car which is Honda I was present because Honda has a logo specific kind of a logo a Maruti was present. But if it is very fast what would happen is you will mix up everything. And so, you tend to tell me that a blue Maruti was present where

whereas, the truth is that of course, a blue car was present of course, a Maruti was present, but what happened is they were not the same and this is what is called illusory correlation.

So, treisman and Schmidt 1982 interesting study showed that when attention is diverted or overloaded participant makes something called illusory correlation. So, if I give you more than one job to do, if in the in our previous example as I defined if I give you 2 job for example, if I ask you very simple questions of what was the car color or what was the car model it is an easy answer. But when I mix them together which model which car, and which color then the problem becomes more. And since it was presented for very, very brief period of time this illusory correlations do happen.

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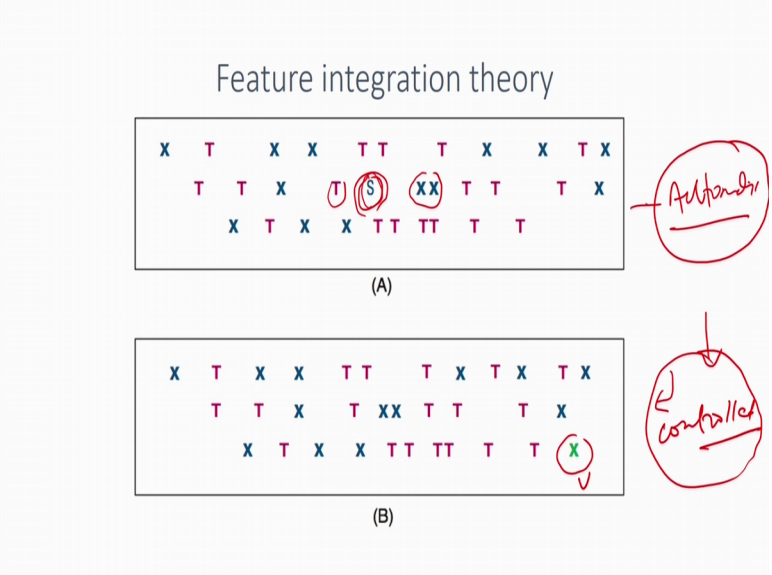

So, in terms of in terms of an attachment this kind of display was used knowing. The first display it is very easy because people were asked to report n S, right. Just a letter S or a particular color of or double X or S or a T, tell me those letters which appear in the pink color or tell me those letters which are different than the display. So, most of the most of the display as X as an ts and S is the only one which is different. And so, this kind of questions can be very easily answered. And this requires automatic nearly automatic processing or no attention at all. Because this pops up, and this is what is call attention of capture what happens is that this particular thing pops up it moves out.

You may have seen these websites several websites which are there, when you visit a website what really happens is that certain things keep moving at the bottom or certain things quickly change color. And they catch your attention, but other things do not basically it is a phenomena like this what happens is that this with the very idea that it is different in terms of shape and shape is a very basic feature at the pre-attentive stage itself these get captures. But look at display number 2.

Now in display number 2 if I ask you to find an X which is green in color. So, I will ask you to find a letter which is of different color. So, a letter in a color so, not 2 features to be looked at a different color has to be looked at on a different, letter has to be looked at any of these displays is represented very fast, you can of course, c 2 colors and a different color is there and a different name is there. So, which is the digit which is in a different color 2 features required when 2 features required this becomes more of a controlled processing. So, when more than one because here what would happen is if an illusionary correlation can happen, I will tell you how the how it happens, what happens is if this display is presented very fast, then you tend to say yes, a t with a green color was there, right.

Or if it is very, very fast you would see a v because it looks more or less like this, but then what really happens is that if 2 features are asked a letter with a different color and a different image is what you need to find out if that is what you need to do then a problem exists, because there are 2 features that you are looking into. And so, the 2 piece features has to be somehow combined. Single feature presentation or signal single feature identifications happens in the creativity stage whereas, this multiple feature comp comparison and object recognition require that interface. And so, at the attentive face.

So, this particular task requires the control processing or attentive face to really work and this requires the automatic phase. So, the answer to the question of how perception attentional effects perception is that if tasks are automatic in nature or tasks require a very physical features basic physical features for identification they are or nearly automatic. But if tasks have most stimulus tasks have more features and they require some more processing then attention comes into play. And so, attentional systems are needed.

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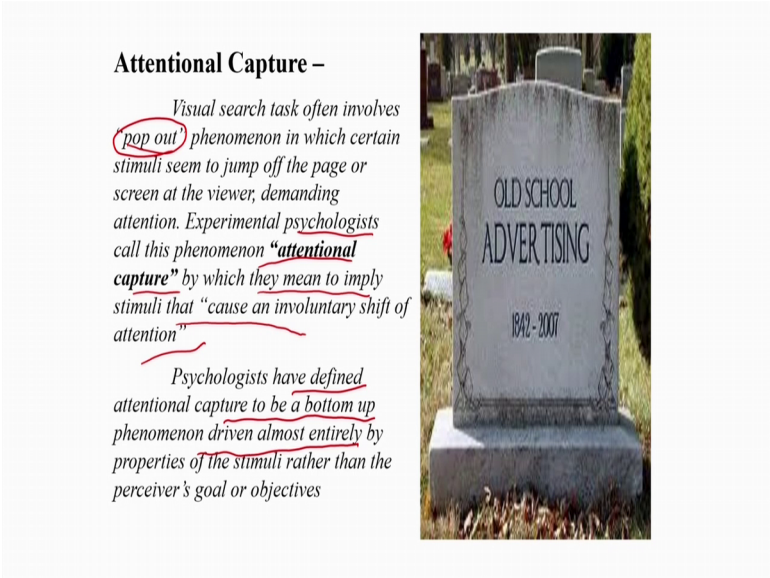

So, very simple tasks do not require attention or they are more or less automatic in nature. A related feature is something called attentional capture, that thing they we were discussing in the studies before. So, visual search tasks they if they use this or they have this pop out phenomena. Remember, the example that I gave you in websites there are certain features there are certain animations out there which quickly change color and form. And so, they capture your attention, and this is called the pop-up phenomena or pop out phenomena. And so, experimental psychologists call these phenomena as attentional capture which means that they mean to imply stimuli that cause an involuntary shift in attention.

So, these features are such that they somehow threw themselves out of the stimulus set which is in work, and they desire your attention or they move out of the display catching your attention. Psychologists have defined attentional capture to be a bottom up process driven entirely or almost by properties of the stimulus rather than perceivable.

So, it is basically it is a stimulus feature which makes something pop out, but it has it has nothing to do with whether the observer has anything to do with it, where the person perceiving has anything to do with it. So, if we look into here if I give you a second to look into here and tell me what is the problem. So, most of you would point out that this is not possible. From 1842 to 2007 is something which is wrong and this captures our attention most people's attention it should be 1942, and this is an error. So, basically this

system which pops out which says that which somehow tells you that this long somebody cannot leave that is what is called attentional capture. So, an interesting experiment was done with attentional capture.

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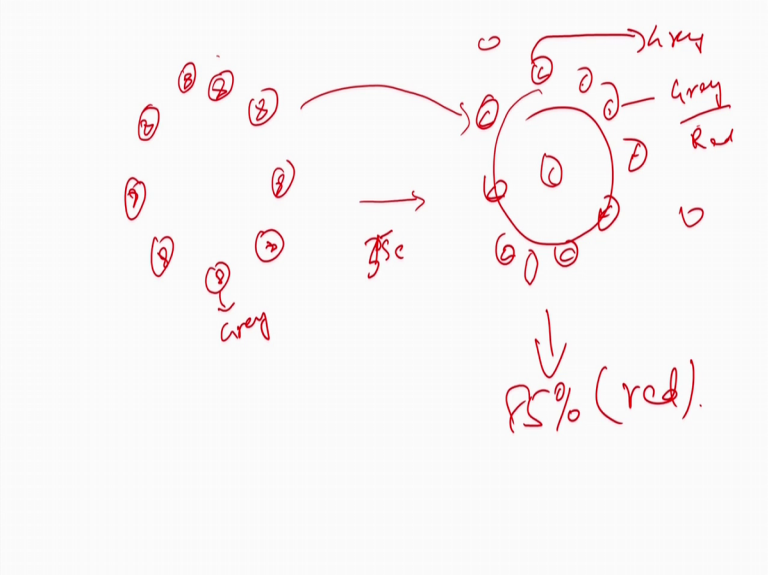

So, what was this experiment? Basically, this experiment had this kind of circles 6 or 7 circles, and at the center of these circles you had the number 8 written on to them. And all these circles were gray in color.

So, this kind of circle was then people were asked to look into this circle. And so, at certain predefined time all, but one circle remember all of these are gray colored circles with the letter 8 into it. So, at a predefined time, let us say after one second or after 5 second all, but one circle they change their color. So, most of the circus change the color from gray to red and so, the inside became c right, one circle let us say this circle remained gray, and this circle all these circles became red. And so, the ins and also the inside of the circles changed from a to c.

Now the question was asked that first of all tell me which of the circles didn't change the color, that thing and what is written inside that circle. Now unknown to the observer an extra red circle appeared either here or somewhere in the display. So, an extra circle with came up into this display and popped up from some from somewhere. And the task is taxing because people have to find out how many circles changed color which ones which was the one which didn't change color and which what is the shift in terms of

letters. And so, when a display like this was used and a sudden letter a certain new circle with red circle appears somewhere in this display with c written on it or with something written on it you would what is the result you would assume.

Most people almost 80 percent people actually saw the red circle appearing. What happened is that irrespective of the fact that people had their attentional blocked up by the task itself, but this circle suddenly appearing somewhere other than this, this particular slot it captured their attention.

So, a red circle in the middle or somewhere here there, it capture the attention and this is what is called attentional capture. Think of it in terms of those websites those things which capture your attention. Things which come out or it come out because they have that the stimulus the those things or those events has certain features, they jump out of the of the screen or jump out of any environment on to you and with the fact that you have nothing to do with it you are not expecting it.

So, kind of an unexpected event and so, this is what this particular theory of attentional capture basically goes ahead and tells us.

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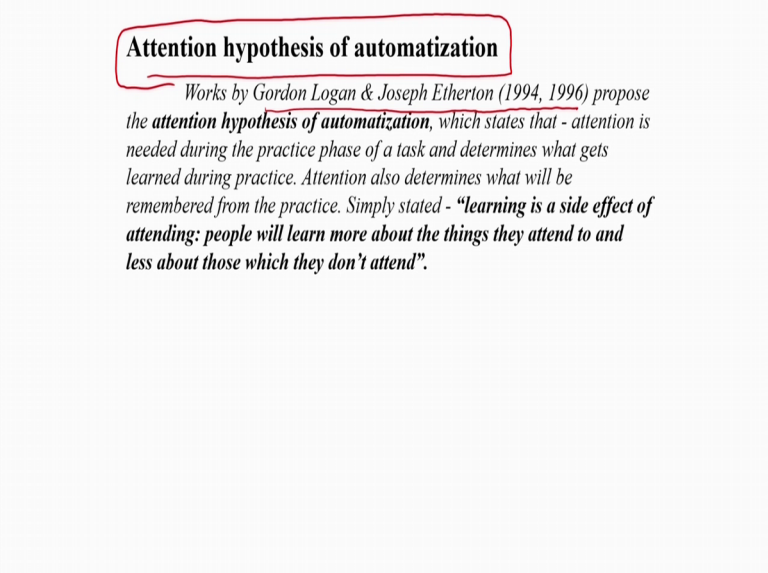

Now so, based on what we have learned up till now Gordon logan, and joseph etherton they combined this idea of what attention is when it becomes automatic. When it becomes control, what are the factors combined all these things together to give and at

attentional hypothesis of attention. Now what is this hypothesis? This hypothesis is very simple nature, what it says is that attention is only required at the practice phase of any task. And so, as soon as you have started practicing as soon as you have enough practice that task becomes automatic.

But if something changes in the stimuli in which it is being presented again a practice is required. Or the fact that so, basically attentional hypothesis of atomization stage that attention is needed just during the practice phase of a task and determines what gets laundering practice. So, and attention also determines what will be remembered from practice.

So, simply say it says that basically learning is a byproduct of attention, but if something else changes into the stimuli then what happens is you do not learn it. And so, you need a attentional stage to further follow. So, just at the time of learning a task you need attention, and once you have learned it enough the task somehow becomes automatic. It is basically what experience would suggest.

So, if you are a tennis player at the initial hours, you need all kind of attention to learn what is the backend for end what is your serve and so on and so forth and how to do the footwork in these kind of things, but once you know this task very well playing tennis is almost automatic in nature until unless something changes. And they did a very good experiment to prove that it is practice that require this kind of attention.

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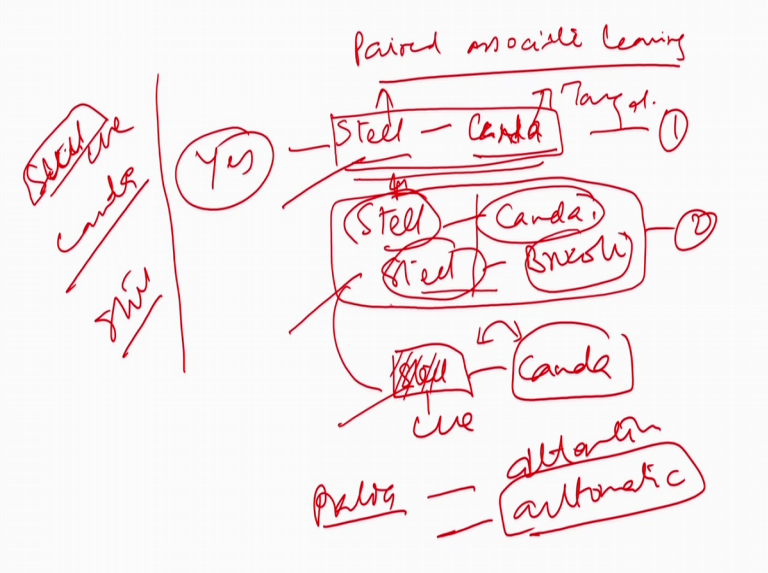

So, they use something called they had associate learning to prove that this kind of atomization hypothesis appears, which means that practice requires atomization, and after practice requires a tangent sorry and after that the task becomes automated. So, they use this kind of a pair associate tasks, in their task what they had they had this kind of pairs. So, you had the word steel which is attached to a word let us see Canada, right. And these kinds of pairs were presented to people and so, people had to learn this kind of a task. So, this kind of pair associate has to be learned. And in one version of the task this steel was never paired to any other word.

And so, they were very specific in terms of this. In another version of the task the word steel was sometimes paired to Canada, whereas, sometimes it was pair to let us say broccoli another word which is there. Now in this case you see that performance has increased and tasks become automatic, or the processing becomes automatic since steel on Canada are related only one.

So, if I do a retrieval of this task it is more or less automatic, but in this case were steel sometimes appear with Canada, the task is paired associated to most pair to associate tasks required to learn both the pairs and at retrieval you are given the Q, this is the Q. So, in this case steel is called the Q and you when I say the Q steel the person who is responding the person who is retrieving back has to tell me the target.

So, Canada here is called the target. And so, person has to the person who is responssing back ha to tell Canada. So, this is the kind of job. So, when steel is specifically related to Canada, the performance becomes rather automatic. And so, what happens is that only during the practice of it you need to put more focus. And so, task learning is very fast. But in terms when it is in the second case when steel is related to Canada somehow, another terms in another version of it is steel is also related to broccoli, when I stay steel the performance does not become automatic.

And so, you have to actually think use your brain and use more attention to come up with the particular answer to the question. Also, it was shown that even if one part of this pair associate learning if the Q was colored in some way, if the Q was green in color and this was right in color. Even in those cases, this learning was very slow and it was not automatic it required. The lot of attention which means that failures were huge, it took more time corresponding.

So, this is more faster this is more slower, and even changing one part of this the Q part of it required people more time. So, basically this task somehow this experiment goes ahead and proves that only during practice you need attention. Whereas, once the practice is over it is automation or the automatic processing starts happening you do not need attention that much. But only in those cases where nothing is changed from the original display.

If something is changing the original display is some form of changes made then attention will again be plotted back or required back.

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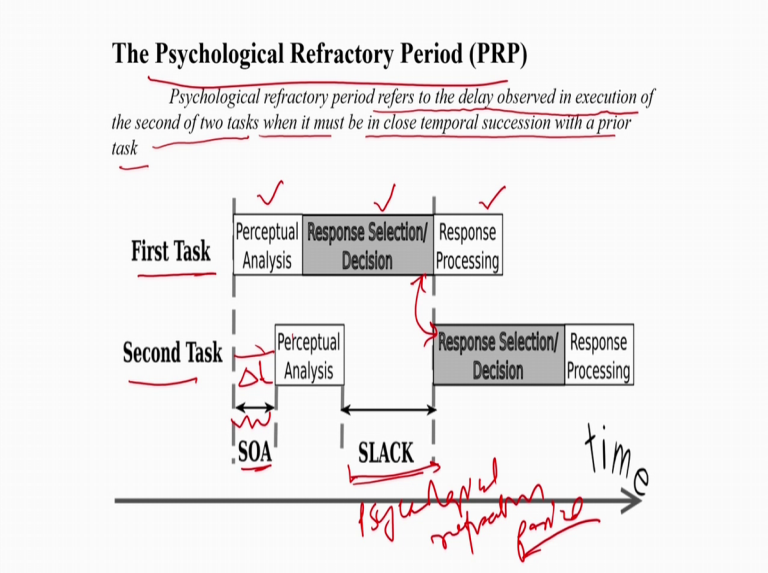

An interesting thing or an interesting feature of this attention or this task of attention is something called a psychological refractive period. So, you would have seen that the premise of this whole thing is that with attention with more practice this attention becomes more or less automatic things become automatic. So, the question is are there tasks where no matter how much practice you do it does not become automatic, are they tasks which are there and so, to prove that principle something called psychological refractory period was defined.

So, psychological refractory period the existence of this period basically says that there are certain kind of tasks, or there are certain kind of scenarios I no matter how much practice you do with a particular task, what really happens is that you tend to have no automaticity or very less automaticity into it. So, how does the thing really work? So,

psychological refractive period refers to the delay observed in execution of a or the second of the 2 tasks which must be in close temporal succession with this task.

So, basically, I will be finding the experiment and then let you know what this particular thing is. So, 2 tasks were actually given let us first look at the pattern of how it happens. So, there is a first task the if 2 tasks are there. And so, what we are trying to see is what is the reason why 2 tasks are given and enough practice is given in to both the task where both the tasks are well learn still we do not see them being automatic why this happens. So, we seeing that.

So, let us say this is the first task, now there are 3 stars 3 stages to a task one is the perceptual analysis one is the response selection the another is the response processing. So, if a job is given to a task is given to the first thing is you have to look at what the task is the intuiting phase then select a response to particular that task and then go ahead, and respond to it. Now if a second task is given to you in quick succession, right. In this so a means stimulus onset asynchrony, how close this is a time dimension.

So, del t how much close these stimulusses are ill explain to you in the in the next figure. And so, in a second while the first task is being preceded a second task starts. Now this particular slack which is there which says that the delayed response selection, if a second task comes in when the first task is being processed this is called the psychology called refractive period.

What does it really mean? It means that if 2 tasks are presented to you and even if they are very well learned tasks. But as the first task is being processed, a second task is also introduced what will really happen, that the second task will get delayed in terms of processing, and this delay that you see is what is called the psychological refractive period.

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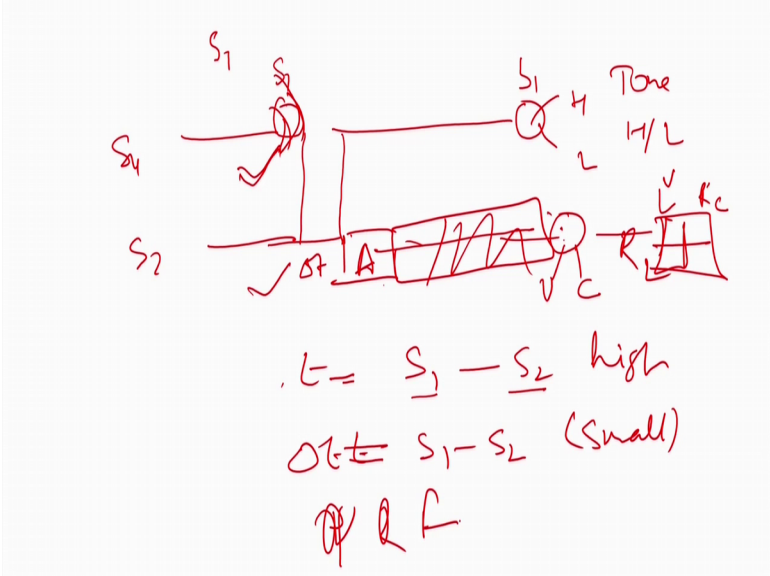

Now, in the original experiment of this PRP what happened is our stimulus was presented as first stimulus was presented to people, and this stimulus was a simple stimulus.

People had to hear a tone. So, we had 2 tones we had a high tone, and we had a low tone and people had to hear this tone and basically. So, this is the hearing part. So, you hear this tone and then categorize it whether it is a high tone or low tone. This is stimulus number one. A second stimulus was given which was delayed a little bit. So, once this stimulus was given once the tone task started a little bit a del t time after that a second task was given to you a second task was in terms of either letter identification.

So, an image was presented to in front of you and what you had to do is look at this image. So, if an image of a was presented to you, what you had to do is look at this A. So, basically this is the display you see an A and when you see letter vowel or a consonant you have to press a different button. So, a button pad is given to you have to press the left button, if it is a vowel and the right button if it is a consonant. So, 2 tasks are there one task is the tone matching task.

So, you have to tell whether it is high or low, and when and the other is the letter identification task when you see a letter you have to press a particular button. Now what is the experimental paradigm say? So, the experimental paradigm says that if enough time if delta t, right the time between S 1 and S 2 is high, then performance of the second task does not require or happens flawlessly second task proceeds as usual. But as you

start narrowing this delta t, if you start bringing this delta t this t or rather instead of delta t at say t here.

So, t is the time difference between S 1 and S 2, but as soon as you start narrowing this t, as soon as you start presenting this S 1 and S 2 in quick successions, if the time difference between presentation of this task S 1 and S 2 is high what would happen is that response delay would happen, which means that response for the second task will get delayed more, and more and which basically means that the response to the first task hardly after the response to the first task or certain delay will come in before the response of the second task coming.

So, quickly understand the paradigm of this 2 tasks are given to you task one tone matching task 2 is identifying images. And so, what happens is as the difference between these 2 tasks are more if the task one completes and the second task starts after that, no delay is there or even between if it starts no delays there and so now, psychological refractive period. But if the first task and second task happen near to simultaneous if first task is started and just within a delta t time or very less time after the start of the first task the second task is reduce. The response to the second task delays and this delays called the psychological refractive period. So, this delta t or this response this slack the time that it takes for response r 2 to happen is what is called the psychological refractive period.

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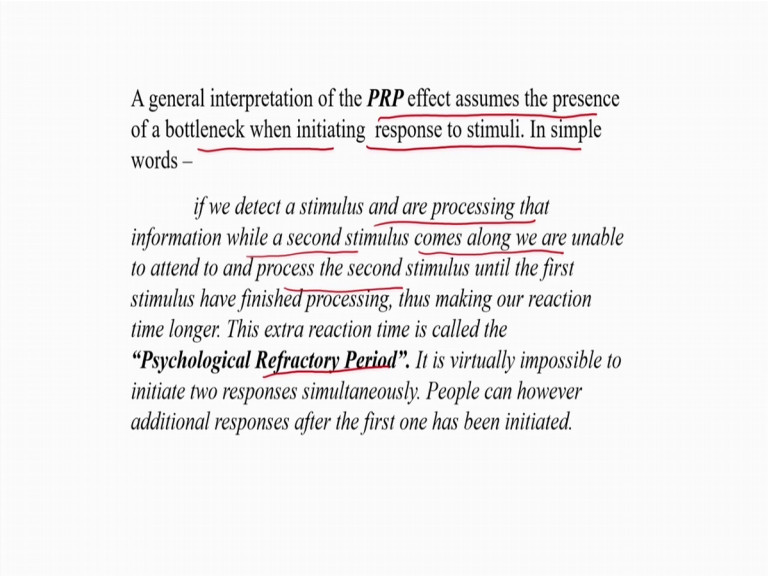

So, a general interpretation of the PRP effect assumed the presence of a bottleneck when initiating a response to stimuli. Now in very simple words you detected a stimulus and are processing that information while the second stimulus comes along, we are able to attend to the second stimulus and that is what is the psychological refractory period.

Now, the question is why does PRP happen or where is this bottleneck. This delay the bottle neck is the delay of which is there in responding to the second task.

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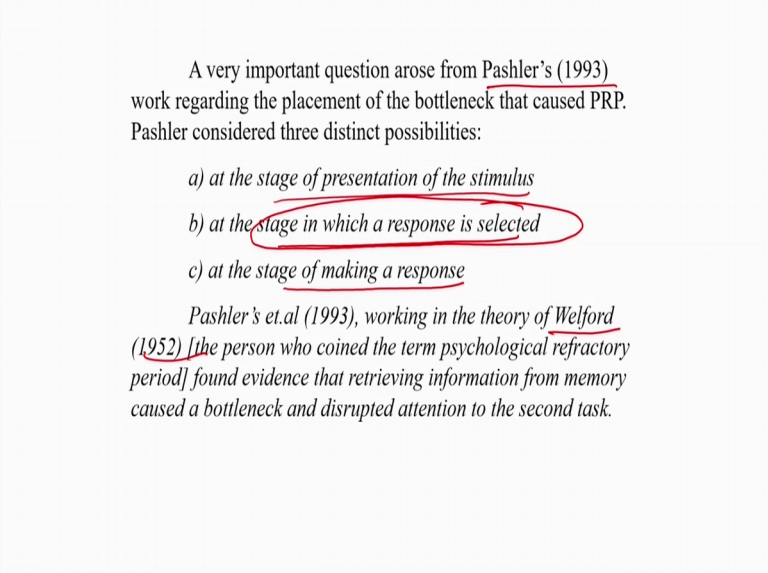

So, where is this delay coming from where is this delay happening and so, 3 answers have been given by Pashler in Pashler 1963 and was Pashler 1963 states that there are 3 interpretations of it. It could be at the stage of presentation the second stimulus. What could happen is the bottleneck have happens because the second stage the presentation of the second stimulus is very free.

And so, this delay occurs because the presentation of the second stimulus is in quick succession. Or it could be the stage of which a response is selected for the first stimulus. So, basically or it could be at the stage of making a response. So, 3 scenarios can exist where I have as I said this is my stimulus presentation.

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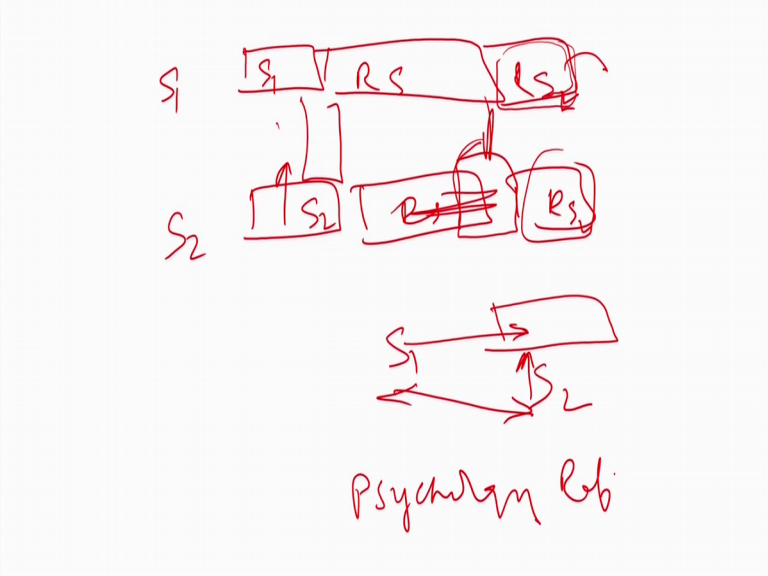

This is my response selection, and this is my response for stimulus. One whereas, for the second case this is my S 2, this is my response selection to S 2, and this is my response to S 2. So, response to S 1 and response to S 2 and there are 3 scenarios the bottleneck can appear because of because of the fact that this second stimulus appears, because the presentation second stimulus or it could be because the response selection of this happens.

And so, since the response selection has not happened a slack happens here or it could be because of the response giving out of the response or emitting the response creates this kind of a bottleneck which is there. And the most prominent example or most prominent answer which has been given the Pashler and on Welford theory is that at the stage of response is selected.

So, what happens here is that at the stage of selection of a response, if a second stimulus comes in if a second stimulus comes in when the first response or the first stimulus is still being processed a response of it is being selected, what will happen is you will observe psychological refractive period. But if the response has already been selected, but the response has not been given in those cases the psychological refractory period will not occur. Think of it in terms of a example.

You go to a bank teller. Who is working on a job. So, cause you so, customer one comes in and asks the question. Now as soon as the question is put into this person this bank

teller is searches for an answer. Now a second customer comes in and asks the question. Psychological refractive period will only occur if the second person the second customer puts a question and this question interferes, or comes in or is appears at the time when the bank teller, or when the bank person is still searching for an answer; is doing a response selection still searching for an answer for the cost customer.

In case the bank teller has already found the answer and it is only the response that he has to give no kind of slack will happen, and both responses will be automatic you could answer to both the persons at the same point of time. But then in cases where the person the bank teller is still working at an answer, and you put your question quickly what really happens is that second stimulus get processed delayed. Get processed at a later point of time and the delay that it takes from response selection for response selection of stimulus 1 2 there is 2 2 response selection to the static of response selection of item 2 is what is called the psychological defective period.

So, in very simple terms the time slack which happens or the time lag which happens for the processing of a second stimulus when S 1 and represent S 2 are presented very nearly in equal time that, and that happening because the response selection for stage one or stimulus 1 is still happening and S 2 of arrives at a time, when S 1s response selection is still being taking place is what is called psychological refractive period. Or psychological refractive period in very, very simple terms is a delay on response to stimulus 2 because stimulus 1 is still getting processed. But if the processing has happened, if the answer has is present then psychological refractory period will not occur.

So, in this section in this particular class we looked at what is atomization, what does the factors of atomization, how to test atomization, what is controlled processing and automate and automatic processing in attention, and we also looked at what is called how attention is part of perception, how attention plays apart into perception we looked at attentional capture and also something called psychological refractory period. Which means that even if 2 jobs, even if 2 tasks, are very automatic even if it is well learn task, still the idea that one task comes in quick succession, or it comes quickly after the other task hence the response selection or the kind of answer to the first task is not been selected from the memory then it creates.

So, basically psychological refractory period is a memory related phenomena. And so, that creates time delay and response of the second stimulus, and that is what is called the psychological refractive period. So, this is an end to the section on attention will meet again with a new section on memory.

Thank you.